AMENDMENTS TO THE CLAIMS

1.   (Currently Amended) A method for recognition, ~~such as classification and/or localization~~ of three dimensional objects, said one or more objects being imaged so as to provide a recognition image being a two dimensional digital image of the object, said method utilises a database in which numerical descriptors <u>of features in</u> ~~are stored for~~ a number of training images <u>are stored, where</u> [[the]] numerical descriptors <u>of a feature comprise:</u> ~~the intrinsic and extrinsic properties of a feature~~

   <u>numerical descriptors for extrinsic properties of the feature, which numerical descriptors comprise a location and an orientation of the feature in the image, and</u>

   <u>numerical descriptors for intrinsic properties of the feature that are invariant to orientation of the object image, which numerical descriptors are derived after a homographic transformation applied to the feature,</u>   .

said method comprising:

   <u>performing the following elements at least partially on at least one electronic device:</u>

   identifying features<u>,</u> ~~being predefined sets of primitives,~~ <u>in</u>[[for]] the recognition image<u>, each feature comprising a set of primitives;</u>

   extracting numerical descriptors <u>for extrinsic and intrinsic properties</u> of the features <u>in the recognition image;</u> ~~said numerical descriptors being of the two kind:~~

   ~~extrinsic properties of the feature, such as the location and orientation of the feature in the image, and intrinsic properties of the feature derived after a homographic transformation being applied to the feature~~

   matching <u>the extracted numerical descriptors</u> ~~said properties~~ with those stored in the database ~~and~~

   in case a match is found assign the object corresponding to the properties matched in the database to be similar to the object of the object to be recognised.

2.   (Currently Amended) A method according to claim 1, for matching a recognition image with training images stored in a database, wherein the matching ~~comprising~~ comprises the following steps:

for each training image:

determine ~~determining~~ the values of roll, tilt and pan of the transformations bringing the features of the recognition image into closer alignment ~~to be identical~~ with the features of the training image;

identify clusters in the parameter space defined by the values of roll, tilt and pan determined by said transformations; and

identify clusters having ~~predefined~~ a particular intensity as corresponding to an object type and localization.

3.   (Currently Amended) A method according to claim 1, wherein the database comprises ~~comprise~~ for each image one or more records each representing ~~a feature with its~~ intrinsic properties and [[its]] extrinsic properties of a feature.

4.   (Currently Amended) A method according to claim 3, wherein the matching comprises the steps of:

resetting the roll, tilt and pan parameter space[[,]];

for at least a subset of the features ~~each feature~~ in the recognition image, matching properties of the recognition image with the properties stored in the database[[,]];

in case of a match: determining roll, tilt, and pan based on the extrinsic properties from the database and from the recognition image[[,]];

updating the parameter space[[,]]; and

testing ~~test~~ for clustering and storing ~~store~~ coordinates of clusters with sufficiently high density or population ~~density/population~~ with an index of the training image,

repeating the steps until all features in at least the subset of the recognition image have been matched.

5. (Currently Amended) A method according to claim 4 wherein the ~~determination~~ determinations of the roll, tilt and pan ~~are only done~~ are only performed for features having similar or identical intrinsic properties compared to the intrinsic properties in the database.

6. (Currently Amended) A method according to claim 4 wherein the matching comprises selecting matching features by comparing the intrinsic descriptors of the recognition image with the intrinsic descriptors stored in the database ~~thereby selecting matching features~~.

7. (Currently Amended) A method according to claim 1, wherein the generation of said database comprises determination of contours, preferably level contours, and primitives in a digital image, said determination comprising the steps of:

generating [[the]] gradients of the digital image;

finding one or more local maxima of the absolute value of the gradients;

use the one or more local maxima as seeds for generating contours, the generation of the contours for each seed comprising determining an ordered list of points representing positions in the digital image and belonging to a contour;

for all of said positions determining [[the]]a curvature, ~~preferably determined as d0/ds preferably pixel units,~~ of the contours;

from the determined curvatures determine primitives ~~as characteristic points on or segments of the contours~~.

8. (Original) A method according to claim 7 further comprising the step of eliminating potential seed points identified near already defined contours.

9. (Currently Amended) A method according to claim 7, wherein the generation of the contours comprises~~comprising~~ assigning the list of points representing positions in the digital image, each point having a value being assigned to be common with the value of the seed.

10. (Currently Amended) A method according to claim 7, wherein the generation of the contours comprises ~~comprising~~ assigning the list of points following in each point the direction of the maximum or minimal gradient detected perpendicular to a contour direction.

11. (Currently Amended) A method according to claim 7, wherein the generation of the contours comprises ~~comprising~~ assigning the list of points with values ~~being~~ above or below the value of the seed and one or more neighbour pixels with a value below or above said value of the seed.

12. (Original) A method according to claim 7, wherein the list of pixels is established by moving through the digital image in a predetermined manner.

13. (Currently Amended) A method according to claim 8, wherein the contours ~~being~~ are determined from an interpolation based on the list of pixels.

14. (Original) A method according to claim 8 wherein the list is an ordered list of pixels.

15. (Original) A method according to claim 7, wherein the gradients are determined by calculating the difference between numerical values assigned to neighbouring pixels.

16. (Currently Amended) A method according to claim 7, wherein the gradients are stored in an array in which each element corresponds to a specific position in the first image and ~~being~~ a numerical value representing the value of the gradient of the first image's tones in the specific position.

17. (Original) A method according to claim 7, wherein the curvatures being established as $K = d\theta/ds$ where θ is the tangent direction at a point on a contour and s is the arc length measured from a reference point.

18. (Currently Amended) A method according to claim 7, wherein the primitives comprise <u>at least one of</u> ~~of one or more of the following characteristics~~:

> segments of straight lines,

> segments of relatively large radius circles,

> inflection points,

> points of maximum numerical value of the curvature~~, said points being preferably assigned to be corners~~,

> points separating portions of very low and very high numerical value of the curvature, and

> small area entities enclosed by a contour.

19. (Currently Amended) A method according to claim 7, wherein each contour is searched for one or more of the following primitives:

> inflection point, being a region of or a point on the contour having values of the absolute value of the curvature being higher than a ~~predefined~~ <u>particular</u> level;

> concave corner, being a region of or a point on the contour having positive peaks of curvature;

> convex corner, being a region of or a point on the contour having negative peaks of curvature;

> straight segment, being segments of the contour having zero curvature; <u>and</u>~~and/or~~

> circular segments, being segments of the contour having constant curvature.

20. (Currently Amended) A method of generating a database<u> for object recognition</u> ~~useful in connection with localizing and/or classifying a three dimensional object, said object being imaged so as to provide a two dimensional digital image of the object~~ <u>comprising</u>:

> <u>performing the following elements at least partially on at least one electronic device:</u>

>> ~~wherein the determination of~~ <u>determining</u> the primitives in a<u>[[the]]</u> two dimensional digital image<u> of an object, the determination comprising</u> ~~of the object comprises the steps of~~<u>:</u>

generating the gradients of the digital image;

finding one or more local maxima of the absolute <u>value of the</u> gradients;

use the one or more local maxima as seeds for generating contours, the generation of the contours for each seed comprising determining an ordered list of points representing positions in the digital image and belonging to a contour;

<u>determining the curvature</u> for <u>at least a subset of the</u> ~~all of said~~ positions ~~determining the curvature, preferably determined as dθ/ds preferably pixel units, of the contours~~<u>; and</u>

<u>determining primitives</u> from the determined curvatures~~determine primitives as characteristic points on or segments of the contours.~~

~~said method further comprising:~~<u>;</u>

identifying features~~, being predefined sets of primitives,~~ in a number of digital images of one or more ~~object~~<u>objects, each feature comprising a set of primitives</u>~~, the images represent different localizations of the one or more object~~;

extracting and storing in the database[[,]] numerical descriptors of the features, said numerical descriptors <u>comprising</u> ~~being of the two kind~~:

~~extrinsic properties of the feature, that is the location and orientation of the feature in the image, and~~

~~intrinsic properties of the feature being derived after a homographic transformation being applied to the feature~~

<u>numerical descriptors for extrinsic properties of the feature, which numerical descriptors comprise a location and an orientation of the feature in the image, and</u>

<u>numerical descriptors for intrinsic properties of the feature that are invariant to orientation of the object image, which numerical descriptors are derived after a homographic transformation applied to the feature.</u>

21. (Original) A method according to claim 20 further comprising the step of eliminating potential seed points identified near already defined contours.

22. (Currently Amended) A method according to claim 20, wherein the generation of the contours comprises ~~comprising~~ assigning the list of points representing positions in the digital image, each point having a value being assigned to be common with the value of the seed.

23. (Currently Amended) A method according to claim 20, wherein the generation of the contours comprises ~~comprising~~ assigning the list of points following in each point the direction of the maximum or minimal gradient detected perpendicular to a contour direction.

24. (Currently Amended) A method according to claim 20, wherein the generation of the contours comprises ~~comprising~~ assigning the list of points with values ~~being~~ above or below the value of the seed and one or more neighbour pixels with a value below or above said value of the seed.

25. (Original) A method according to claim 20, wherein the list of pixels is established by moving through the digital image in a predetermined manner.

26. (Original) A method according to claim 21, wherein the contours being determined from an interpolation based on the list of pixels.

27. (Original) A method according to claim 21 wherein the list is an ordered list of pixels.

28. (Original) A method according to claim 20, wherein the gradients are determined by calculating the difference between numerical values assigned to neighbouring pixels.

29. (Currently Amended) A method according to claim 20, wherein the gradients are stored in an array in which each element corresponds to a specific position in the first image and ~~being~~ a numerical value representing the value of the gradient of the first image's tones in the specific position.

30. (Original) A method according to claim 20, wherein the curvatures being established as x=dθ/ds where θ is the tangent direction at a point on a contour and s is the arc length measured from a reference point.

31. (Currently Amended) A method according to claim 20, wherein the primitives comprise <u>at least one of</u>~~of one or more of the following characteristics~~:

       segments of straight lines,

       segments of relatively large radius circles,

       inflection points,

       points of maximum numerical value of the curvature, said points being preferably assigned to be corners,

       points separating portions of very low and very high numerical value of the curvature, and

       small area entities enclosed by a contour.

32. (Currently Amended) A method according to claim 20, wherein each contour is searched for one or more of the following primitives:

       inflection point, being a region of or a point on the contour having values of the absolute value of the curvature being higher than a ~~predefined~~ <u>particular</u> level;

       concave <u>corner</u>~~comer~~, being a region of or a point on the contour having positive peaks of curvature;

       convex corner, being a region of or a point on the contour having negative peaks of curvature;

       straight segment, being segments of the contour having zero curvature;

<u>and</u>[[and/or]]

circular segments, being segments of the contour having constant curvature.

33. (Original) A method according to claim 1, wherein the extrinsic properties comprises a reference point and a reference direction.

34. (Original) A method according to claim 1, wherein the intrinsic properties comprises numerical quantities of features.

35. (Currently Amended) A method according to claim 1, wherein the object being imaged by at least two imaging devices thereby generating at least two recognition images of the object and wherein the method according to claim 1 is applied to each recognition image and wherein the <u>matches</u> ~~match~~ found for each recognition image are compared.

36. (Currently Amended) A method according to claim 35, where the method <u>comprises</u> ~~comprising the steps of~~:

  for each imaging device, providing an estimate for the three dimensional reference point of the object,

  for each imaging device, calculating a line from the imaging device pinhole to the estimated reference point,

  and when at least two or more lines have been provided,

  discarding the estimates in the case that the said two or more lines do not essentially intersect in three dimensions,

  and when the said two or more lines essentially intersect,

  estimating a global position of the reference point based on the pseudo intersection between the lines obtained from each imaging device.

37. (New) The method of Claim 1, wherein the primitives comprise a point on, a segment of, or an area enclosed by, a contour of an image.

38. (New) The method of Claim 20, wherein the primitives comprise a point on, a segment of, or an area enclosed by, a contour of an image.